

and the spindle 113 is threaded so as to receive a securing nut 121 on the opposite side of the spindle receiving portion 111 to secure the spindle 113 in position. The through bore 112 can extend through the spindle receiving portion 111 of the spring 101 at an angle with respect to horizontal, e.g. approximately eight degrees, to give the spindle 113 and attached bearing 122 and disc blade 42 the preferred angle, e.g. eight degrees, as previously mentioned.

FIGS. 9-12 illustrate a variety of alternative configurations of leaf spring which are usable with the present invention. FIG. 9 illustrates a U shaped spring 131 generally consistent with the above description, i.e. with an upper leg 132 which is substantially the same length as a lower leg 133. FIG. 10 illustrates a different U shaped spring 134 with an upper leg 135 which is substantially shorter than a lower leg 136. In FIG. 11, a spring 141 is essentially L shaped, with a lower leg 142 attached to a disc spindle and a front leg 143 extending substantially vertically. Finally, FIG. 12 illustrates a shape somewhat between that of FIG. 10 and FIG. 11, i.e. a spring 144 includes a lower leg 145 with a curved front leg 146 which extends upward and rearward at a substantial angle with respect to vertical. Any of the shapes illustrated in FIGS. 9-12 can be used with the present invention, the common feature being attachment of a lower spring leg proximate a disc spindle such that the disc is positioned alongside at least a portion of the lower spring leg.

Other variations on the inventive disc mounting system and method will occur to those of ordinary skill in the art. For example, the implement 31 has been illustrated and described as a disc-ripper-disc implement, but the disc mounting system is not limited to such an implement. For example, the disc mounting system can also be used effectively with an implement in which chisel shanks or other ground working tools are substituted for the ripper shanks 55. Furthermore, although only the front discs 42 have been described as incorporating the inventive mounting system, if desired, both front and rear discs can be so mounted. Accordingly, it is to be understood that while certain forms of the present invention have been illustrated and described herein, it is not to be limited to the specific forms or arrangement of parts described and shown.

What is claimed and desired to be secured by Letters Patent is as follows:

**1.** An individual disc mounting system for an agricultural implement having a plurality of individual disc blades, the mounting system comprising:

- a leaf spring with an upper leg and a lower leg connected by a closed end, said lower leg having a longitudinal axis and a bottom surface generally parallel to said longitudinal axis;
- a mounting apparatus configured to attach said upper leg to the implement, such that said lower leg longitudinal axis is oriented generally horizontally; and
- a disc spindle apparatus attached to said leaf spring lower leg such that said disc spindle apparatus extends outward from said lower leg in a direction which is generally transverse to said lower leg bottom surface, said disc spindle apparatus supporting a bearing which accommodates only one of the individual disc blades such that the disc blade is positioned alongside a portion of said leaf spring lower leg and is freely rotatable relative to said spring lower leg, wherein positioning of said leaf spring at least partially alongside the disc blade allows the disc blade to deflect vertically, horizontally and/or torsionally when it encounters an obstacle.

**2.** A disc mounting system as in claim 1, wherein said disc spindle apparatus is attached to said leaf spring lower leg

such that said disc spindle apparatus is canted at an angle in the range of 3 to 13 degrees from horizontal.

**3.** A disc mounting system as in claim 2, wherein said disc spindle apparatus angle is approximately eight degrees from horizontal.

**4.** A disc mounting system as in claim 1, wherein said leaf spring lower leg includes a spindle mounting portion with a through bore extending substantially horizontally there through.

**5.** A disc mounting system as in claim 1, wherein said leaf spring is generally U shaped.

**6.** An agricultural disc mounting system for attaching individual disc blades to an implement, comprising:

- a leaf spring with an upper leg and a lower leg connected by a closed end, wherein said leaf spring closed end is canted at an angle with respect to vertical such that said upper leg is offset with respect to said lower leg;
- a mounting apparatus configured to attach said upper leg to the implement; and
- a disc spindle apparatus attached to said leaf spring lower leg such that said disc spindle apparatus extends outward from said lower leg, said disc spindle apparatus supporting a bearing which accommodates one of the individual disc blades such that the disc blade is positioned alongside a portion of said leaf spring lower leg and is freely rotatable relative to said spring lower leg, wherein positioning of said leaf spring at least partially alongside the disc blade allows the disc blade to deflect vertically, horizontally and/or torsionally when it encounters an obstacle.

**7.** A disc mounting system as in claim 6, wherein each said disc is formed with a concave outer surface and the angle of said leaf spring closed end approximates the angle formed by the outer concave surface of an attached disc.

**8.** A disc mounting system as in claim 6, and further comprising a shield attached to the leaf spring, said shield including a side covering portion which is positioned to cover a portion of a side opening of said leaf spring sufficient to keep soil and residue from entering said side opening.

**9.** A disc mounting system as in claim 8, wherein said shield further includes a rear covering portion which covers a portion of a rear opening of said spring sufficient to keep soil and residue from entering said rear opening.

**10.** A disc mounting system as in claim 8, and further comprising a disc scraper blade which is attached to said shield rear covering portion in a position to scrape a concave side of the attached disc blade.

**11.** An agricultural implement including a plurality of front disc blades positioned proximate a front end of the implement with the front disc blades being spaced laterally across the implement, a plurality of rear disc blades attached to the implement proximate a rear end thereof, with the rear disc blades also being spaced laterally across the implement, and a plurality of ground working tools having ripper shanks attached to the implement with each of the ripper shanks being positioned intermediate the front and rear disc blades, the improvement comprising a disc mounting system for attaching said disc blades to said implement, comprising:

- a leaf spring with an upper leg and a lower leg connected by a closed end;
- a mounting apparatus configured to attach said upper leg to the implement; and
- a disc spindle apparatus attached to said leaf spring lower leg such that said disc spindle apparatus extends outward from said lower leg, said disc spindle appara-

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tus supporting a bearing which accommodates only one of the disc blades such that the disc blade is positioned alongside a portion of said leaf spring lower leg and is freely rotatable relative to said spring lower leg, wherein positioning of said leaf spring at least partially alongside the disc blade allows the disc blade to deflect vertically, horizontally and/or torsionally when it encounters an obstacle.

**12.** A disc mounting system as in claim 11, wherein said disc spindle apparatus is attached to said leaf spring lower leg such that said disc spindle apparatus is canted at an angle in the range of 3 to 13 degrees from horizontal.

**13.** An implement as in claim 12, wherein said disc spindle apparatus angle is approximately eight degrees from horizontal.

**14.** An implement as in claim 11, wherein said leaf spring lower leg includes a spindle mounting portion with a through bore extending substantially horizontally therethrough.

**15.** An implement as in claim 11, wherein said leaf spring is generally U shaped.

**16.** An agricultural implement including a plurality of front disc blades positioned proximate a front end of the implement with the front disc blades being spaced laterally across the implement, a plurality of rear disc blades attached to the implement proximate a rear end thereof, with the rear disc blades also being spaced laterally across the implement, and a plurality of ground working tools having ripper shanks attached to the implement with each of the ripper shanks being positioned intermediate the front and rear disc blades, the improvement comprising a disc mounting system for attaching said disc blades to said implement, comprising:

a. a leaf spring with an upper leg and a lower leg connected by a closed end, wherein said leaf spring closed end is canted at an angle with respect to vertical such that said upper leg is offset with respect to said lower leg;

b. a mounting apparatus configured to attach said upper leg to the implement; and

c. a disc spindle apparatus attached to said leaf spring lower leg such that said disc spindle apparatus extends outward from said lower leg, said disc spindle apparatus supporting a bearing which accommodates one of the disc blades such that the disc blade is positioned alongside a portion of said leaf spring lower leg and is freely rotatable relative to said spring lower leg, wherein positioning of said leaf spring at least partially alongside the disc blade allows the disc blade to deflect vertically, horizontally and/or torsionally when it encounters an obstacle.

**17.** An implement as in claim 16, wherein each said disc is formed with a concave outer surface and the angle of said leaf spring closed end approximates the angle formed by the outer concave surface of an attached disc.

**18.** An implement as in claim 16, and further comprising a shield attached to the leaf spring, said shield including a side covering portion which is positioned to cover a portion of a side opening of said leaf spring sufficient to keep soil and residue from entering said side opening.

**19.** An implement as in claim 18, wherein said shield further includes a rear covering portion which covers a portion of a rear opening of said spring sufficient to keep soil and residue from entering said rear opening.

**20.** An implement as in claim 18, and further comprising a disc scraper blade which is attached to said shield rear covering portion in a position to scrape a concave side of the attached disc blade.

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**21.** A method of mounting an individual disc blade to an agricultural implement, comprising the steps of:

a. providing a leaf spring with an upper leg and a lower leg connected by a closed end, said lower leg having a longitudinal axis and a bottom surface generally parallel to said longitudinal axis;

b. mounting said leaf spring upper leg to the implement, such that said lower leg longitudinal axis is oriented generally horizontally; and

c. attaching a disc spindle apparatus to said leaf spring lower leg in a position such that said disc spindle apparatus extends outward from said lower leg in a direction which is generally transverse to said lower leg bottom surface, said disc spindle apparatus supporting a bearing which accommodates only one disc blade such that the disc blade is positioned alongside a portion of said leaf spring lower leg and is freely rotatable relative to said leaf spring lower leg.

**22.** A method as in claims 21, wherein said attaching step includes the step of attaching said disc spindle apparatus to said leaf spring lower leg such that said disc spindle apparatus is canted at an angle in the range of 3 to 13 degrees from horizontal.

**23.** A method as in claim 22, wherein said disc spindle apparatus angle is approximately eight degrees from horizontal.

**24.** A method of mounting a disc blade to an agricultural implement, comprising the steps of:

a. providing a leaf spring with an upper leg and a lower leg connected by a closed end;

b. mounting said leaf spring upper leg to the implement;

c. attaching a disc spindle apparatus to said leaf spring lower leg in a position such that said disc spindle apparatus extends outward from said lower leg, said disc spindle apparatus supporting a bearing which accommodates one disc blade such that the disc blade is positioned alongside a portion of said leaf spring lower leg and is freely rotatable relative to said leaf spring lower leg; and

d. attaching a shield to the leaf spring, said shield including a side covering portion which is positioned to cover a portion of a side opening of said leaf spring sufficient to keep soil and residue from entering said side opening and a rear covering portion which covers a portion of a rear opening of said spring sufficient to keep soil and residue from entering said rear opening.

**25.** A method as in claim 24, and further comprising the step of attaching a disc scraper blade to said shield rear covering portion in a position to scrape a concave side of the attached disc blade.

**26.** An agricultural disc mounting system for attaching individual disc blades to an implement, comprising:

a. a leaf spring with an upper leg and a lower leg connected by a closed end, said leaf spring closed end being canted at an angle with respect to vertical such that said upper leg is offset with respect to said lower leg;

b. a mounting apparatus configured to attach said upper leg to the implement; and

c. a disc spindle apparatus attached to said leaf spring lower leg such that said disc spindle apparatus extends outward from said lower leg, said disc spindle apparatus supporting a bearing which accommodates only one of the individual disc blades such that the disc blade is positioned alongside a portion of said leaf spring lower

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leg and is freely rotatable relative to said spring lower leg, wherein positioning of said leaf spring at least partially alongside the disc blade allows the disc blade to deflect vertically, horizontally and/or torsionally when it encounters an obstacle.

**27.** A disc mounting system as in claim 26, wherein each said disc is formed with a concave outer surface and the angle of said leaf spring closed end approximates the angle formed by the outer concave surface of an attached disc.

**28.** An agricultural disc mounting system for attaching individual disc blades to an implement, comprising:

- a. a leaf spring with an upper leg and a lower leg connected by a closed end;
- b. a mounting apparatus configured to attach said upper leg to the implement;
- c. a disc spindle apparatus attached to said leaf spring lower leg such that said disc spindle apparatus extends outward from said lower leg, said disc spindle apparatus supporting a bearing which accommodates only one of the individual disc blades such that the disc blade is positioned alongside a portion of said leaf spring lower leg and is freely rotatable relative to said spring lower leg, wherein positioning of said leaf spring at least partially alongside the disc blade allows the disc blade to deflect vertically, horizontally and/or torsionally when it encounters an obstacle; and
- d. a shield attached to the leaf spring, said shield including a side covering portion which is positioned to cover a portion of a side opening of said leaf spring sufficient to keep soil and residue from entering said side opening.

**29.** A disc mounting system as in claim 28, wherein said shield further includes a rear covering portion which covers a portion of a rear opening of said spring sufficient to keep soil and residue from entering said rear opening.

**30.** A disc mounting system as in claim 28, and further comprising a disc scraper blade which is attached to said shield rear covering portion in a position to scrape a concave side of the attached disc blade.

**31.** An implement as in claim 11, wherein said leaf spring closed end is canted at an angle with respect to vertical such that said upper leg is offset with respect to said lower leg.

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**32.** An implement as in claim 31, wherein each said disc is formed with a concave outer surface and the angle of said leaf spring closed end approximates the angle formed by the outer concave surface of an attached disc.

**33.** An implement as in claim 11, and further comprising a shield attached to the leaf spring, said shield including a side covering portion which is positioned to cover a portion of a side opening of said leaf spring sufficient to keep soil and residue from entering said side opening.

**34.** An implement as in claim 33, wherein said shield further includes a rear covering portion which covers a portion of a rear opening of said spring sufficient to keep soil and residue from entering said rear opening.

**35.** An implement as in claim 33, and further comprising a disc scraper blade which is attached to said shield rear covering portion in a position to scrape a concave side of the attached disc blade.

**36.** A method of mounting a disc blade to an agricultural implement, comprising the steps of:

- a. providing a leaf spring with an upper leg and a lower leg connected by a closed end;
- b. mounting said leaf spring upper leg to the implement;
- c. attaching a disc spindle apparatus to said leaf spring lower leg in a position such that said disc spindle apparatus extends outward from said lower leg, said disc spindle apparatus supporting a bearing which accommodates only one disc blade such that the disc blade is positioned alongside a portion of said leaf spring lower leg and is freely rotatable relative to said leaf spring lower leg; and
- d. attaching a shield to the leaf spring, said shield including a side covering portion which is positioned to cover a portion of a side opening of said leaf spring sufficient to keep soil and residue from entering said side opening and a rear covering portion which covers a portion of a rear opening of said spring sufficient to keep soil and residue from entering said rear opening.

**37.** A method as in claim 36, and further comprising the step of attaching a disc scraper blade to said shield rear covering portion in a position to scrape a concave side of the attached disc blade.

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